
GEOLOGICAL SURVEY OF KENTUCKY.

JOHN R. PROCTER, DIRECTOR.

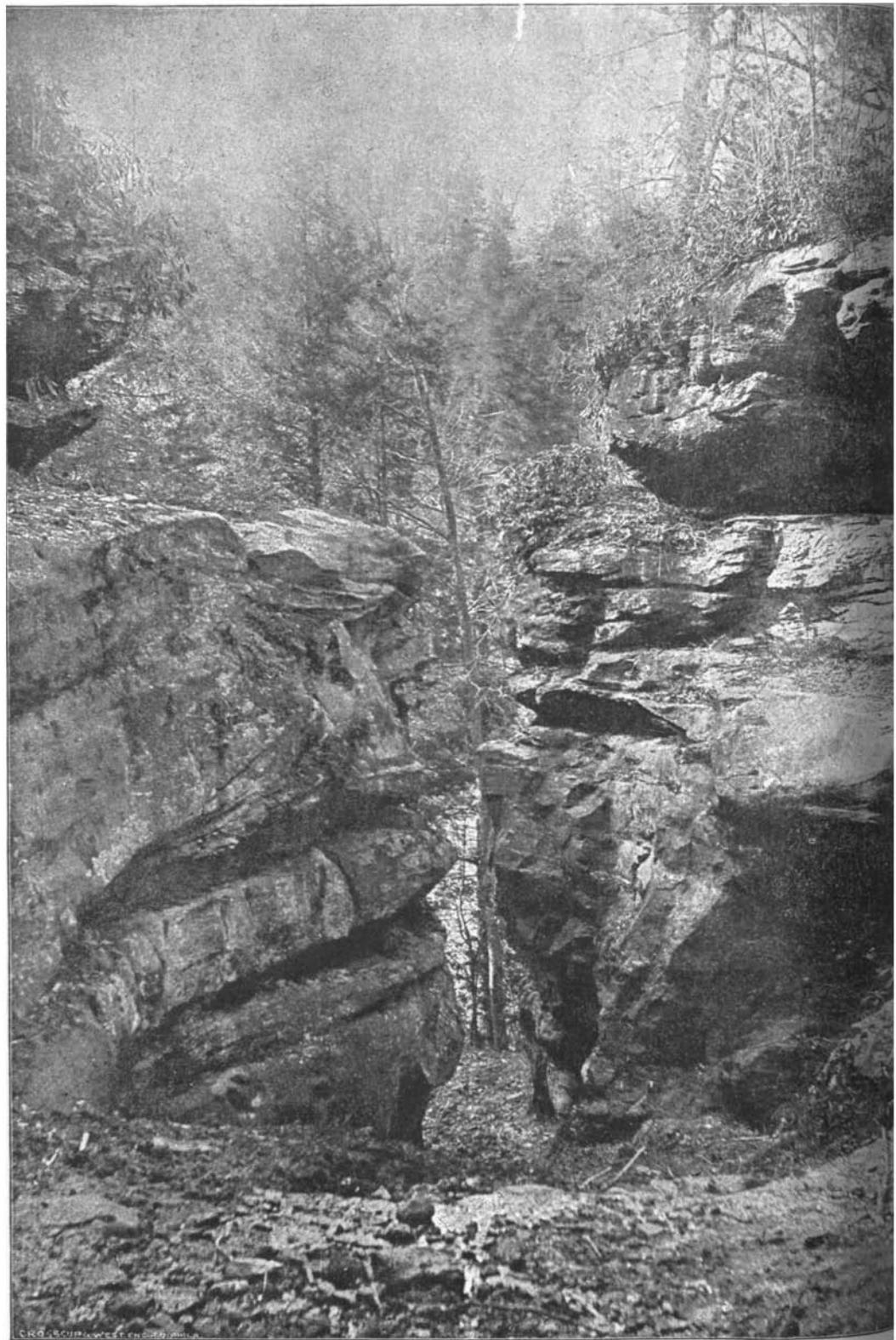
REPORT

ON THE

GEOLOGY OF ELLIOTT COUNTY.

BY A. R. CRANDALL.

STEREOTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER AND BINDER, FRANKFORT, KY.



"KENTUCKY GAP," a Natural Roadway out of the Big Caney Creek Canon.

INTRODUCTORY LETTER.

J. R. PROCTER, *Director of the Kentucky Geological Survey:*

I herewith transmit to you my report on the Geology of Elliott county. In so doing, perhaps it may be proper for me to state that it has been made up from data gathered together by such brief studies, and at such times during the progress of the work in the upper counties, as the exigencies of the case have permitted. It is therefore more general in some respects than otherwise might have been expected. On the other hand it will, I think, be found to contain such an outline of the geology of the county as will be most serviceable in calling attention to its natural adaptations; leaving some interesting problems in the geological history of the region for discussion in connection with the general geology of Eastern Kentucky as is preferable.

The accompanying map is made up in part from surveys by the Eastern Kentucky Railway Company (the officers of which have also generously facilitated the work in this county in many ways), from the Portsmouth and Pound Gap preliminary line, and from Lesley's outline map; but chiefly from surveys made by Assistants C. G. Blakeley and J. A. Shackleford, under the direction of the present Geological Survey. From the nature of the drainage this work has been unusually difficult, and in consequence the map is not as complete in detail as is desirable. In this connection it should be stated that the county line, as shown on the map, is made to conform only in a general way with the meanders of the county survey as indicated by the notes on record in the clerk's office at Martinsburg. Since the publication of this map, I have been informed that the upper part of Big Sinking creek, from about one-half mile above the Olive

Hill and Martinsburg road, at Dr. Campbell's, should be included in Elliott rather than in Carter. As the map is already printed, this statement must suffice to correct the line as plotted from the notes of the county survey.

Illustrations of the topography of Elliott, by photo-lithography, are added to the general descriptions, both as a matter of economy in space and of accuracy of delineation, which the text alone could not present.

In plate one an illustration is given of the composition of a vertical section from notes of observations in the field. This has been thought desirable in order that the general reader may be the better able to form a correct estimate of the value of geological sections, as introduced in reports generally to show the serial order of beds.

Finally, acknowledgments are due for hospitality and for assistance from the people of Elliott, with whom the members of the survey have come in contact in the prosecution of the work represented by this report.

A. R. CRANDALL, *Assistant.*

REPORT ON THE GEOLOGY OF ELLIOTT COUNTY.

Elliott county is wholly within the coal-field of Eastern Kentucky. Its western boundary is very nearly also the western limit of the coal-measures. Geographically it falls between Rowan county on the north-west, Morgan on the south and south-west, Lawrence on the south-east, and Carter on the north and north-east. In its relation to the drainage it is almost entirely in the valley of the Little Sandy; including the head waters of that river. The county line follows with some deviations the water-shed between the Little Sandy waters and the waters of Big Blaine, Big Paint, Elk Fork, North Fork and Triplet creek—tributaries of the Chatterawha or Big Sandy river and the Licking, which, with the Little Sandy, form a radial drainage from the high land of this region. On the north the line is an arbitrary one, stretching across the valley of the Little Sandy, which also includes most of Carter and Greenup counties.

With such modifications as follow from the geology of this county, its surface features are like those of Carter and Greenup, and in marked contrast with Morgan and Menifee south-westward along the border of the coal-field. The conglomerate escarpment of these counties, broken and irregular from the erosion of streams running for the most part contrary to the dip of the rock formations, disappears to the northward of the Morgan and Elliott line; and the border escarpment is continued as an ordinary ridge, forming an unbroken water-shed through to the Ohio river, the western boundary of Elliott, Carter and Greenup counties. From this water-shed of Lower Carboniferous sandstone and shale (the Waverly beds) the eastward drainage follows the direction of the dip until interrupted, as it is somewhat irregularly, by successive coal-measure escarpments which deflect

the main streams to the northward through these counties.
(See maps with this and previous Report.)

The increased thickness of the conglomerate sand rock to the southwest along the eastward slope of this main watershed gives greater prominence in Elliott to a feature which is one of the characteristic contributions of this formation to the topography of the country, namely, cliff-bound creeks. Travelers on the Chesapeake and Ohio Railway remark the massive walls along the Little Sinking creek in Carter. Here the conglomerate sandstone shows a thickness of seventy to ninety feet. In Elliott the cliffs reach a maximum of one hundred and seventy-five feet. This massive formation has a dip eastward less than the whole fall of the streams. Very little of it remains along the eastern slope of the main ridge at the head of the cliff-bound creeks of Elliott; but it becomes prominent not far from the heads of all the main streams in question, and, by a series of rapids and falls, the whole or the greater part of the formation is exposed in the wall-like cliffs which mark the tortuous courses of the streams below. On Laurel creek and on Caney, as well as on the Little Sandy for some miles, the Subcarboniferous limestone is exposed, rising to a height of twenty-five feet above the bed in places. The conglomerate sand rock here rests upon the limestone, with slight traces of transition beds. As may well be supposed, the natural scenery along these creeks is unusually interesting and varied. (See accompanying photo-lithographic illustrations.)

East of the Little Sandy river the cliffs rapidly disappear; both the dip and the direction of the water-courses conspiring to place the conglomerate sand rock below the beds of the creeks in this direction. Elliott county, therefore, illustrates two types of topography. In the cliff region, as indicated by the shading on the map, the narrow and abrupt valleys are separated by comparatively broad table-lands. As the cliffs disappear to the eastward the valleys become more open, and the hills are reduced to the characteristic narrow ridges and spurs of the productive coal-measures.

The conglomerate table-lands are diversified by drainage slopes of moderate inclination and height, including, near

Topography Near Head of Gimblet Creek.



"CONGLOMERATE CLIFFS" on Little Sandy River, near Mouth of Laurel Creek.
ELLIOTT COUNTY, KY.

the river, a considerable thickness of the coal-bearing series of rocks, with coals one and two of the general section. These lands are, however, chiefly agricultural; and as such they offer inducements which are not found in the coal-field generally. (See photo-lithograph illustration.) The soil is of sandy and clayey loam, of medium natural fertility, and susceptible of improvement by judicious cultivation. In extent these lands include nearly one-half of the county, the area of which is about 270 square miles. This region is adjacent to the Chesapeake and Ohio Railway, being from fifteen to twenty-five miles from Morehead, in Rowan county, and eight to twenty-five miles from Olive Hill and Leon in Carter—railway stations.

The available farm land in the eastern part of the county is much less in proportion to the whole area than in the western; and it is mostly in the valleys, including the gentler slopes. The steeper hillsides and the narrow ridges should be regarded as timber land, and held as such for the benefit of the valleys, which otherwise will soon pay the penalty by excessive washing. This region is nearer the Eastern Kentucky Railway, being six to twenty miles distant from Willard, the present terminus of that road.

The timber growth of Elliott is largely of the hard woods, including, however, a considerable proportion of yellow poplar (tulip tree) and linn (basswood). Hemlock is the prevailing growth along the conglomerate cliffs, and yellow pine (*P. mitis*) and other pines fringe the table-lands. The most valuable timber lands are found in the eastern half of the county, which is especially noted for its superior white oak timber. The red maple is noticeably prominent in this part of the county. Black walnut and ash are represented by single trees distributed through the heavier forests, while the beech and the sugar tree are more common. No detailed study of the forest growth of this region has been made. Such a study would be of great economic value, if only it could be made to conduce to an intelligent treatment of these natural forest lands. This, it seems to me, should be the aim in respect to the forests of Kentucky, as it is evident that the commercial spirit of the age will need no incentive to

carry its destructive methods wherever desirable timber can be found.

The geology of Elliott county is so much like that of the western portion of Greenup and Carter that treating of it will of necessity seem like repetition. There is one feature of more than ordinary interest, which does not appear, so far as is known at the present time, elsewhere in the State, namely, exposures of trappean rock; the occurrence of profound fractures of the ordinary sedimentary rocks of the region, as indicated by the intrusion of molten rock, forming dikes and producing more or less of metamorphism of the including rocks.

Several of these dikes, or what may prove to be several lateral branches of a single dike, are found apparently radiating from a point on Creeches creek, westward and northward into the valley of Isom creek. This intrusive rock, peridotite, though hard and to ordinary appearance very indestructible, is, in fact, even less so than the including Carboniferous beds; so that it is for the most part covered; and it is not traceable by any effect produced on the topography of the region.

A fuller description of this interesting variation of the geology of Eastern Kentucky will be found in a special report by J. S. Diller, of the United States Geological Survey, and the writer, including the petrology of these crystalline rocks, and the geological features attendant on this eruption.

It is proper here, however, to put on record something of the part which this trap rock has played in the industry and the traditions of the region.

One of the most prominent exposures of this rock is on a branch of Creeches creek. Here is also found the remains of a rude furnace, but one which must have cost considerable labor, judging from the size of the mound which appears to have been thrown up to support it and to serve as a stock bank for ore and fuel. So far as I have been able to learn, the traditions of the immediate region throw no light on the origin of this furnace, further than to attribute it to the aborigines, or to a time anterior to the permanent settlement of the region. Attending this view is also the supposition



"CONGLOMERATE CLIFF" on Laurel Creek.

that silver or some of the precious metals was the product of this ancient enterprise. On the other hand, it seems to me quite likely that this old furnace represents an unsuccessful attempt to make iron; and that it should be regarded as one of the incidents in the history of the introduction of the iron industry in the Hanging Rock region. This supposition is consistent with the conditions as noted about the old furnace, although, so far as that goes, there is nothing inconsistent with the supposition that silver or some other metal was the product sought in this bootless enterprise. At all events, it seems to me probable that the precious metal view, responding as it does to the promptings of hope and of fancy, and carrying with it an atmosphere of credulity and of mystery, has so tended to obscure the history of this old furnace and the unfortunate venture which it represents, that it may properly be regarded as having a place in the unwritten chronicles of the settlement of this region, notwithstanding the popular notion to the contrary.

Whatever may have been the specific purpose of this furnace, only the dike rock, exposed near by, appears to have been had in contemplation as a source of ore supply. The weathered rock bears some resemblance to iron ore, and in fact more or less of titaniferous iron is present; besides which, no other metallic ore has been found at any of the exposures of this rock.

As to the probability of the occurrence of the more precious metals, not much can be said, beyond this, that the metamorphism in connection with this dike is probably limited to thin contact walls, with some lateral extensions accompanying horizontal intrusions of limited extent.

COALS AND IRON ORES.

The coal and ore horizons of Elliott county are the same as those of Carter, as will be seen by comparison of sections 1 and 2, plates I and II of this report, with the general section for Greenup, Carter, etc.* Above the ferriferous

* For convenience of comparison and to facilitate the description of the beds in Elliott, the general section for Greenup, Carter and a part of Lawrence is here republished. (See plate.)

limestone, both the coals (6, 7 and 8) and the ores (the kidney ores), with some exceptions, become less and less prominent towards the border of the field. This thinning out of beds of coal and of iron ore is in keeping with the tendency which has been noted generally towards their western limits; a tendency that is accompanied in some instances by a corresponding thickening of the intervening rocks. The limestone beds in the coal measures all disappear towards the Silurian axis on the west.

Towards the southern part of Elliott this diminution of beds westward is coincident with a change in the character of the rocks of this horizon, which has been noted southward from Carter and the middle of Lawrence; a change from the predominating clayey shales which carry these beds, to predominating sand rock, which soon excludes the kidney ores altogether as workable deposits, and makes the identification of coals 7 and 8 difficult and uncertain. Whether this change is from a thinning out of the whole series, so that with its coals and ores it disappears altogether, or from a gradual change in the character of the rock deposits, has not been fully established; the latter seems to be more consistent with the somewhat contradictory data at hand, and more especially with the great thickening of the coal measures, and the increased prominence of sand rock towards the Pine mountain axis. (See report on the Pound Gap region.)

The kidney ores have been mined in the Little Fork valley near the north-east corner of the county. Their presence has been noted to the head of Little Fork, mostly on the east side of the valley, but also westward, with decreasing prominence into the valley of Newcomb creek, and in the ridge between Newcomb and the Middle Fork. In this ridge, near the Martinsburg road, the lower bastard limestone which marks the place of one of the upper kidney ores, of Boyd county, may be seen near the top of the hill. The occurrence of this earthy limestone, the Buff or Shawnee limestone of the Ohio reports, is interesting as showing the extension southward and westward of one of the four earthy limestone beds above coal 7; beds which, in Southern Ohio and in Boyd county,

and parts of Lawrence and Carter, in Kentucky, may be regarded as offering the most reliable horizon marks for the guidance of the geologist. These beds all disappear or lose their characteristic features south of the Little Sandy drainage.*

The coarse sandstone, conglomerate sandstone in places, which often rises in cliffs above the lower bastard limestone in Boyd and Carter counties, caps some of the hills towards the head of Little Fork, on the east side. (See plate I.) Dipping down the valley, as already indicated, it forms a considerable part of the ridge along the northward extension of the county line, and probably caps some of the highest hills on the west side of the valley.

No trace of coal No. 8 has been noted in Elliott county. Its place is twenty feet or more below the earthy limestone above mentioned, and it would be included in all sections of the ridge along the eastern boundary, and of some of the higher points across to the ridge between Newcomb and the Middle Fork.

Coal 7 has been observed at a number of places, along with the kidney ores, as in section 1, plate II. At the head of Brushy creek, near the place of Bryan Boggs, a thickness of forty-two inches is shown, including a thin parting. It is exposed also near Gallions, on Blaine Trace, as a prominent stain. Its western limit is the ridge between Little Fork and Bruin creek, with its continuation against Newcomb creek to near the head of Little Fork, and then across Newcomb to include the higher hills along the Middle Fork to the head. The probabilities are that it will be found of local value only, in this south-western extension.

Coal 6 has been traced in the Little Fork valley as far as Hurricane branch, evidently a thin bed as in Carter county. Its place in the series is shown in section 1, plate II. The greatest thickness noted falls below two feet of good coal.

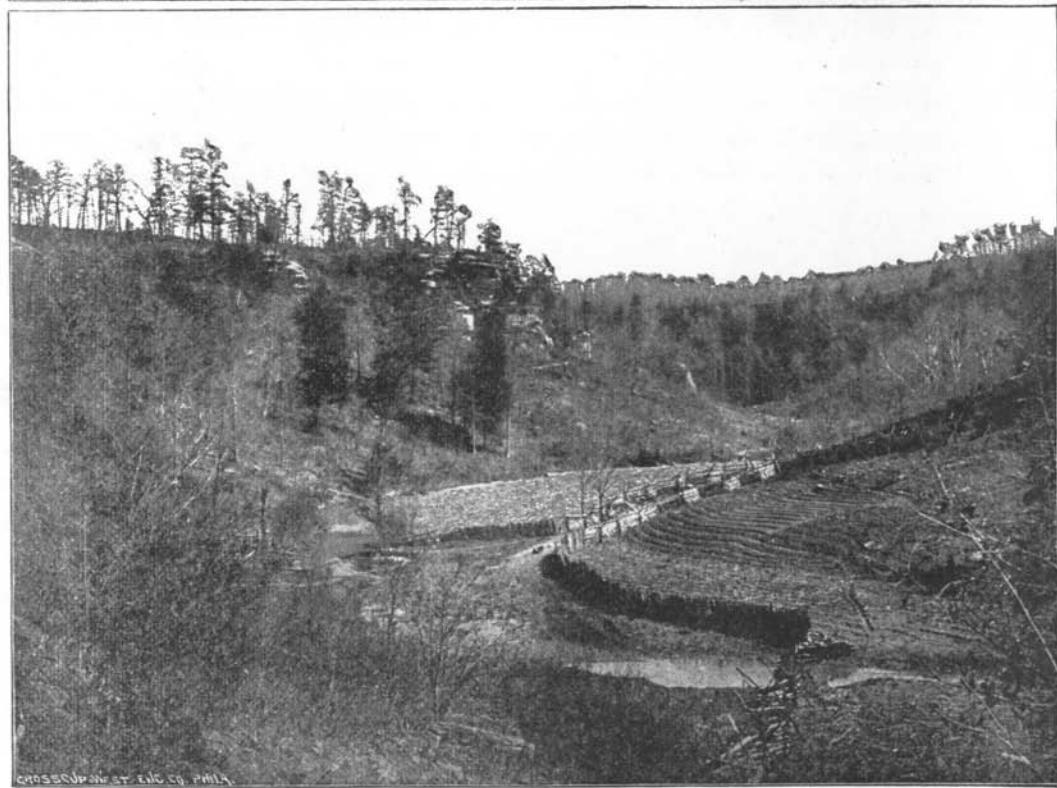
The ferriferous limestone and the so-called limestone ore mark a geological level that is more readily traced than any

* A cherty limestone is found in Breathitt county, extending into Perry and possibly into Letcher, which may prove to be an equivalent of one of these beds. (See report of Assistant Hodge on Perry and the southwestern part of Letcher.)

other above the conglomerate formation. The limestone is limited to isolated pockets, and has been seen at two points only in Elliott—on the head of Isom creek, where it occurs as a fossiliferous bed five feet or more in thickness, and on the head of Elk branch of Newcomb creek, where it is less prominent. It has also been noticed at several points along the ridge west of Elk Fork, in Morgan county. The ore which rests upon this limestone when it is present is more constant, however, and can generally be found weathered out upon the surface at its proper level. At the mouth of Brushy creek it is found about one hundred and fifty feet above the bed of Little Fork, and has been mined for shipment, though the distance from rail and the character of the roads stand in the way of profitable mining as it now stands. On Isom creek it is about two hundred feet above the drainage, showing very little variation from the general dip of the region—an unexpected freedom from disturbance in the immediate region of the dike as previously described. On the head of Little Fork the limestone ore is well up towards the tops of the hills, and often has intermingled with it enough small quartz pebbles to render it worthless for iron-making. Westward the ore has been traced along the ridges from Bruin creek to the head of the Middle Fork. It is especially prominent as a surface exposure on the ridge between the head of the Fannin Fork of Elk, above Hutchinson's store, and the Gilbert Branch of Middle Fork. It is hardly to be expected that this iron ore is present in workable thickness and quality over all of the region where its presence is indicated by contour lines of outcrop. Far more constant than the limestone which gives it its name, this bed is more or less interrupted throughout its whole extension south of the Ohio river. From exposures noted it would not appear to be more so in this region than in those parts where it has been largely relied on for furnace supplies of iron ore. In thickness this bed may also be supposed to be variable—ranging from a few inches to several feet, as in regions where it has been extensively mined.

The "lime kidney ore" found in some parts of Carter, and especially near Willard, fifteen to twenty feet below the

Topography above Conglomerate Cliffs on Little Caney Creek.



CROSS & SCHAFFNER, INC., PHILA.

"CONGLOMERATE CLIFFS" at Forks of Caney Creek, Elliot Co., Ky.

ferriferous limestone, appears to be entirely wanting in Elliott; and the same is true of coal 5 of the general section. No traces of this bed have been observed in the county.

The Little Block ore of the general section and the Hunnewell cannel coal (coal 4) are better represented; the former by many exposures in the Little Fork valley, at its proper level, as in section 1, plate I; the latter on the head of Newcomb creek, and also at a few points on Little Fork. This cannel seam does not promise well from an economic point of view; being too slaty or too thin where seen for profitable mining for the open market. As in Greenup and Carter, it appears to interrupt the Little Block ore, occupying very nearly the same horizon. The localities where coal 4 has been noted are as follows: In the Little Fork valley, near the head of Blaine Trace, Blevin's, Anderson's and Triplet's cannel coals; showing in two benches, the lower ten to twenty inches, somewhat slaty; the upper ten to fifteen inches, good cannel, separated from the lower bench by three to five inches of slate. In the Newcomb valley, near the head of the Left Fork, Riddle's cannel; opened at several points in the ridge between the Left Fork and the Middle Fork, and on the east side of Burnt Cabin Branch one-half mile above the steam mill. The thickness of the bed in this region is from three to four feet; of which less than one-half is cannel, after deducting six to eight inches of slate. On the Middle and Right Forks of Newcomb, so far as known, this seam shows only ordinary bituminous coal of reduced thickness, or with slight traces of cannel. The iron ore, which marks this level with much greater regularity, has not been noted in the region of these cannel coals as described. It is found very generally on the Little Fork, and may be supposed to average about as in the corresponding belt in Greenup and Carter. It has been observed by Mr. J. M. Hodge on Isom creek, associated with a so-called Black Band iron ore—a highly ferruginous carbonaceous slate, representing the cannel coal, as also it is represented in Lawrence county at one point by a similar black band.

The alternation of the Little Block with coal 4, and the occasional overlapping of these beds, with a tendency to

transform the coal into a black band, is an interesting indication of the varying conditions under which the carboniferous deposits were laid down. It illustrates, in some measure, the way in which beds of coal and of ore are formed in "basins" or "pockets," giving to them a distribution uneven as to thickness and quality, an irregularity which is more or less characteristic of beds in general, as is found in developing them. But it should be noticed that it is none the less an illustration of the widespread continuity of coal and ore horizons, however much the beds, as workable deposits, are limited by such irregularities.

Coal 3 is the most constant bed in the series so far as unbroken continuity is concerned; but while it is the most reliable coal in North-eastern Kentucky in this respect, it is at the same time apparently more variable in thickness and quality, and in the arrangement of parts, than any other bed. It is the most important coal in Elliott county. In the north-east corner of the county it is thin, as shown in section 1, plate II, twenty-five to thirty feet above the bed of Little Fork, and as known in the adjoining part of Carter. On Blaine Trace the bed shows three feet of good coal without parting, as opened at Blevin's towards the head of the creek. On the Robert Green Branch a thickness of five feet is exposed. (See section, plate II, enlarged scale.) On the head of Nicholas Branch three feet of excellent coal without parting is shown. Southward and westward this seam retains as great a thickness, but slaty and shaly partings become more or less prominent, detracting from the value of the bed by increasing the expense of mining. Coal 3 is found as far west as the Little Sandy river at Martinsburg, high up in the hill, as in section 4, plate II, and there is good reason for supposing that it is present in all the region east of the Open Fork. The place of this coal is often indicated by springy places or "licks" on the hill-sides, besides showing as a stain at the surface. Several openings made from these indications show as follows: On Wallowhole creek, thickness 47 inches, including partings, which have an aggregate thickness of 21 inches; on Prince's Branch west of Little Fork, 48 inches, with parting 11 inches; near the head of

Meadow Branch 44 inches, with partings 10 inches; on Briar Branch, near Bent. Hutchinson's, 53 inches, with partings 17 inches; on the Bill Branch of Newcomb, 50 inches, partings 12 inches; at Mason's, on the Left Fork of Newcomb, 50 inches, with an 8-inch parting. On the Right Fork of Newcomb, and on the Middle and Open Forks of the Little Sandy river, test openings have not been made.

Coal 2 is the lower cannel coal of Elliott, Morgan and Johnson counties, and also of parts of Carter and Lawrence. It is in its southward extension, however, that it becomes a prominent cannel seam, as the Elk Fork, the West Liberty, the Pieratt and the Walnut Grove cannels in Morgan, and probably the Gilmore creek and the Frozen creek cannels in Wolfe and Breathitt counties, though it has been profitably mined in upper Carter for several years near Aden Station, on the Chesapeake and Ohio Railway, where it has a thickness of about 30 inches; somewhat slaty in part, but free from objection in burning qualities, as I find from continued use in the grate. This bed is found in Elliott, as cannel coal wholly or in part, more constantly than is usual for a cannel seam. Its greatest thickness is near the Morgan line on the Buck Branch of the Middle Fork of Sandy, where about three feet of cannel is exposed, of inferior quality, however, from the large proportion of ash—about twenty per cent. At no other exposure in the county does this bed show a workable thickness of cannel coal alone. On the Right Fork of Newcomb, at Adkin's store, this bed shows 19 inches of cannel overlaid by 15 inches of ordinary bituminous coal, and on the Left Fork, at Segrave's, three feet of good coal is exposed, one foot at the bottom being cannel. Elsewhere coal 2, as exposed, is thinner as a whole and variable in its character. It is traceable on most of the creeks of Eastern Elliott, from seventy-five feet above the main drainage and downward to the creek bed. At the mouth of Hurricane Branch of Little Fork no cannel appears in this bed, and it falls below the drainage near the mouth of Isom creek. West of the Little Sandy river the coals have not been traced. It will probably be found that coals 1 and 2 will furnish a home supply for this farming region.

Coal 1 is mostly a thin coal as known. It falls below the drainage for the most part on the open creeks. At the Forks of Newcomb, as opened by Mr. Isom, coal 1 shows three feet of excellent coal. Westward over the cliffs it is shown as a stain, as indicated in the profile section with the map.

The rocks above the conglomerate sandstone differ little from the section as described for Carter county. The thickening of the sand rock above coal 5, as noticed on the head of Dry Fork and of Sycamore creek, on the Blaine side, in Carter, is also a noticeable feature along the ridge at the head of Blaine Trace in Elliott. The cliffs at the head of this creek are of coarse sandstone, resembling somewhat the conglomerate sandstone, and the horizon of coal 6 appears to be occupied by the massive rocks which are most prominent in this region. In general the most prominent bench along the hill-sides of the Little Fork valley is formed by the persistent sand rock immediately under the "limestone ore," though a number of low points extending into the main valley, extensions from the bench formed by the sandstone ledge above coal 2, gives greater prominence to the latter bench where these occur. The alternation of shale and sandstone is more or less noticeable throughout the whole series, in the benched hill-sides which figure in the topography of the country.

